

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 31 October 2000 (31.10.00)	
International application No. PCT/FI00/00174	Applicant's or agent's file reference 49488
International filing date (day/month/year) 06 March 2000 (06.03.00)	Priority date (day/month/year) 05 March 1999 (05.03.99)
Applicant MÄKINEN, Jarmo	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
02 October 2000 (02.10.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

Best Available Copy

Best Available Copy

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38
---	--

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 49488/ML/MB/MM
International application No. PCT/FI00/00174	International filing date (day/month/year) 6 March 2000 (6.3.2000)	(Earliest) Priority date (day/month/year) 5 March 1999 (5.3.1999)
Title of invention DATA TRANSMISSION METHOD AND RADIO LINK SYSTEM		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) NOKIA NETWORKS OY P.O. Box 300 FIN-00045 NOKIA GROUP Finland		Telephone No.: Facsimile No.: Teleprinter No.:
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) MÄKINEN, Jarmo Vahverotie 5 D FIN-02730 ESPOO Finland		
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) 		
State (that is, country) of nationality:	State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*Berggren Oy Ab
P.O. Box 16
FIN-00101 HELSINKI
Finland

Telephone No.:

+358-9-693701

Facsimile No.:

+358-9-6933944

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filed
 the description ☐ as originally filed
 ☐ as amended under Article 34

the claims ☐ as originally filed
 ☐ as amended under Article 19 (together with any accompanying statement)
 ☐ as amended under Article 34

the drawings ☐ as originally filed
 ☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

- ☐ which is the language in which the international application was filed.
☒ which is the language of a translation furnished for the purposes of international search.
☒ which is the language of publication of the international application.
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATESThe applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Berggren Oy Ab

Matti Brax

Matti Brax
Patent Agent

HELSINKI, 2 October 2000

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

For International Preliminary Examining Authority use only

International application No. PCT/FI00/00174

Applicant's or agent's file reference 49488/ML/MB/MM

Date stamp of the IPEA

Applicant

NOKIA NETWORKS OY

Calculation of prescribed fees

1. Preliminary examination fee

SEK 4.200

P

2. Handling fee (*Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.*)

SEK 1.270

H

3. Total of prescribed fees

Add the amounts entered at P and H
and enter total in the TOTAL box.....

SEK 5.470

TOTAL

Mode of Payment

☐ authorization to charge deposit
account with the IPEA (see below)☐ cash☐ cheque☐ revenue stamps☐ postal money order☐ coupons☒ bank draft☐ other (specify):Via SWIFT through
account 5439-10-013-49Deposit Account Authorization (*this mode of payment may not be available at all IPEAs*)The IPEA/ SE ☐ is hereby authorized to charge the total fees indicated above to my deposit account.☐ (*this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit*) is hereby
authorized to charge any deficiency or credit any overpayment in the total fees indicated above to
my deposit account.

Deposit Account Number

Date (day/month/year)

Signature

PCT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE*Berggren Oy Ab*22-09-2000
mm/ml

Date of mailing (day/month/year)

14 September 2000 (14.09.00)

Applicant's or agent's file reference

49488

IMPORTANT NOTICE

International application No.

PCT/FI00/00174

International filing date (day/month/year)

06 March 2000 (06.03.00)

Priority date (day/month/year)

05 March 1999 (05.03.99)

Applicant

NOKIA NETWORKS OY et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,
GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,
NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on

14 September 2000 (14.09.00) under No. WO 00/54434

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

J. Zahra

Telephone No. (41-22) 338.83.38

Continuation of Form PCT/IB/308

**NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF
THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES**

Date of mailing (day/month/year) 14 September 2000 (14.09.00)	IMPORTANT NOTICE
Applicant's or agent's file reference 49488	International application No. PCT/FI00/00174
<p>The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.</p> <p style="text-align: right; font-size: 1.2em;">Best Available Copy</p>	

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 49488	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/FI 00/00174	International filing date (day/month/year) 6 March 2000	(Earliest) Priority Date (day/month/year) 5 March 1999
Applicant NOKIA NETWORKS OY et al.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).
2. ☐ Unity of invention is lacking (See Box II).
3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
 - ☐ filed with the international application.
 - ☐ furnished by the applicant separately from the international application,
 - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
 - ☐ transcribed by this Authority.
4. With regard to the title, ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:
5. With regard to the abstract,
 - ☒ the text is approved as submitted by the applicant.
 - ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
Figure No. 3 ☒ as suggested by the applicant. ☐ None of the figures.
☐ because the applicant failed to suggest a figure.
☐ because this figure better characterizes the invention.

CORRECTED

International application No.

PCT/FI 00/00174

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/24, H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9721287 A1 (ADVANCED MICRO DEVICES, INC.), 12 June 1997 (12.06.97), page 2 - line 34; page 4 - line 16 --	1-9
X	US 5617412 A (M.DELAPRAT ET AL), 1 April 1997 (01.04.97), column 6, line 4 - line 13; column 1, line 38 - line 39 --	1,3,5,6
X,P	WO 9926437 A1 (ERICSSON INC.), 27 May 1999 (27.05.99), page 3, line 18 - line 24; page 3, line 24 - page 4, line 2, abstract --	1-4

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "B" earlier application or patent but published on or after the international filing date
- "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 July 2000

Date of mailing of the international search report

10-07-2001

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Fredrik Blomqvist/AE

Telephone No. +46 8 782 25 00

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

Best Available Copy

To:

Berggren Oy Ab
P.O. Box 16
FIN-00101 HELSINKI
Finland

Berggren Oy Ab

06 -03- 2001

SKU/pur

PCT

WRITTEN OPINION

(PCT Rule 66)

No. 1/5-01 pw/plk

Date of mailing
(day/month/year)

02 -03- 2001

Applicant's or agent's file reference

49488/ML/MB/MM

REPLY DUE

within 60 days
from the above date of mailing

International application No.

PCT/FI00/00174

International filing date (day/month/year)

06.03.2000

Priority date (day/month/year)

05.03.1999

International Patent Classification (IPC) or both national classification and IPC

H 04 B 7/24, H 04 Q 7/20

Applicant

Nokia Networks Oy et al

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 02.10.2000

Name and mailing address of the IPEA/SE

Patent- och registreringsverket
Box 5055
S-102 42 STOCKHOLM
Facsimile No. 08-667 72 88

Telex
17978
PATOREG-S

Authorized officer

Fredrik Blomqvist/mj
Telephone No. 08-782 25 00

I. Basis of the opinion

1. With regard to the **elements** of the international application:*

- ☒ the international application as originally filed
- ☐ the description: 24
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.These elements were available or furnished to this Authority in the following language English which is:

- ☒ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>2, 4-9</u>	YES
	Claims	<u>1, 3</u>	NO
Inventive step (IS)	Claims		YES
	Claims	<u>1-9</u>	NO
Industrial applicability (IA)	Claims	<u>1-9</u>	YES
	Claims		NO

2. Citations and explanations

The claimed invention is an arrangement and method to use both frequency division duplex and time division duplex. A substation transmits at a different time than it receives, and uses different frequencies for the transmission and reception. The central station includes a duplexer so it can both transmit a time division duplex signal at a first frequency and receive signals from one substation at another frequency.

D1) WO 9721287 A1

D2) US 5617412 A

D3) US 5689502 A

Document **D1** presents a system and method for frequency division duplex/ time division duplex radio frequency communications.

Document **D2** presents a method that involves mobile stations are arranged in groups, sharing common uplink and downlink frequencies. One station transmits at a time, with the other stations remain in reception mode. Data are transmitted in frames of fixed, predetermined length, which are grouped into multiframe, with each multiframe containing traffic frames and a monitor frame. Some of the monitor frames are designated as listening frames within which the transmitting mobile interrupts its transmission and moves into reception mode. The frames or multiframe in one direction are delayed by a quarter-period with respect to those in the opposite direction.

Document **D3** shows a time division duplex communication between base and user stations. It transmits user message to base station, which calculates distance between stations based on receipt time, transmits reply to user station including timing adjustment information

.../...

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

Claims 1 and 3

From D1 a FDD/ TDD system and method is presented. There are radio frequency communications between a first and a second unit and the units can operate in TDD mode.

-A first unit transmits during a first time period over a first frequency and the first unit receives during a second time period over a second frequency.

-A second unit transmits during a second time period over a second frequency and the second unit receives during a first time period over a first frequency. (see page 2 line 34 - page 4 line 16)

Here the first and second unit can be a mobile phone(substation) and a base station(central station). This corresponds to what are claimed in claims 1 and 3.

Claims 2, 4-9

That the central station controls the time periods used for transmission and reception by the substations must be obvious for a person skilled in the art.

That the system is located in a GSM, or a UMTS, or a broadband, or a LMDS, or a HiperAccess system must also be obvious for a person skilled in the art.

Therefore, the invention claimed in claims 1 and 3 is not novel and the invention claimed in claims 1-9 is not considered to involve an inventive step.

REC'D 16 JUL 2001

WIPO PCT

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

09/9/3893

Applicant's or agent's file reference 49488/ML/MB/MM		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00174	International filing date (day month year) 06.03.2000	Priority date (day month year) 05.03.1999
International Patent Classification (IPC) or national classification and IPC H04B 7/24, H04Q 7/20		
Applicant Nokia Networks Oy et al		

RECEIVED
MAR 13 2002
Technology Center 2600

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- ☒ Basis of the report
- ☐ Priority
- ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Lack of unity of invention
- ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Certain documents cited
- ☐ Certain defects in the international application
- ☐ Certain observations on the international application

RECEIVED

MAR. 12 2002

Technology Center 2100

Date of submission of the demand 02.10.2000	Date of completion of this report 06.07.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Fredrik Blomqvist/EE Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00174

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages 1, 4-9, as originally filed
pages _____, filed with the demand
pages 2-3, filed with the letter of 25.04.2001
- ☒ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages 10-11, filed with the letter of 25.04.2001
- ☒ the drawings:
pages 1-2, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00174

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-9</u>	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	<u>1-9</u>	NO
Industrial applicability (IA)	Claims	<u>1-9</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention is an arrangement and method to use both frequency division duplex and time division duplex. A substation transmits at a different time than it receives, and uses different frequencies for the transmission and reception. The central station includes a duplexer so it can both transmit a time division duplex signal at a first frequency and receive signals from one substation at another frequency.

D1) WO 9721287 A1

D2) US 5617412 A

D3) US 5689502 A

Document D1 presents a system and method for frequency division duplex/ time division duplex radio frequency communications.

Document D2 presents a method that involves mobile stations are arranged in groups, sharing common uplink and downlink frequencies. One station transmits at a time, with the other stations remain in reception mode. Data are transmitted in frames of fixed, predetermined length, which are grouped into multiframe, with each multiframe containing traffic frames and a monitor frame. Some of the monitor frames are designated as listening frames within which the transmitting mobile interrupts its transmission and moves into reception mode. The frames or multiframe in one direction are delayed by a quarter-period with respect to those in the opposite direction.

Document D3 shows a time division duplex communication between base and user stations. It transmits user message to base station, which calculates distance between stations based on receipt time, transmits reply to user station including timing adjustment information

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00174

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

Claims 1 and 3

From D1 a FDD/ TDD system and method is presented. There are radio frequency communications between a first and a second unit and the units can operate in TDD mode.

-A first unit transmits during a first time period over a first frequency and the first unit receives during a second time period over a second frequency.

-A second unit transmits during a second time period over a second frequency and the second unit receives during a first time period over a first frequency.

Here the first and second unit can be a mobile phone(substation) and a base station(central station).

It must be obvious for a person skilled in the art to go from a TDD signal over to a TDM signal and forming a TDMA signal and therefore claims 1 and 3 do not comprise an inventive step

Claims 2, 4-9

That the central station controls the time periods used for transmission and reception by the substations must be obvious for a person skilled in the art.

That the system is located in a GSM, or a UMTS, or a broadband, or a LMDS, or a HiperAccess system must also be obvious for a person skilled in the art.

Therefore, the invention claimed is novel but the invention claimed in claims 1-9 is not considered to involve an inventive step.

the substations transmit to the central station at their particular frequencies whereby the central station could discriminate the signals of the different substations by their transmission frequencies. In a code division multiple access (CDMA) arrangement the signals on the same signal path are discriminated on the basis of spreading codes.

Fig. 1 shows a prior-art frequency division duplex arrangement for discriminating between the uplink and downlink directions in point-to-multipoint connections. A central station 101 comprises a baseband processing unit 103. A transmitter unit 107 and receiver unit 104 take care of functions related to the transmission and reception of signals. A duplexer unit 105 couples both the transmitter unit 107 and the receiver unit 104 to an antenna so that they can transmit or receive signals through a single antenna 106. The coupling is such that at a particular frequency the duplexer unit 105 couples the transmitter unit 111 to the antenna 106 and at a second particular frequency the duplexer unit 105 couples the receiver unit 104 to the antenna 106. The duplexer unit is usually realized by means of filters. Correspondingly, a substation 102 is arranged so as to comprise the corresponding units for receiving and transmitting signals. The substation 102 includes an antenna 108, duplexer unit 109, transmitter unit 107, receiver unit 110 and a processing unit 112. In the arrangement according to Fig. 1 the central station 101 and substation 102 use two different frequencies f_1 ; f_2 to transmit signals. All substations 102 communicating with one and the same central station 101 use substantially the same transmission frequency to communicate with the central station 101. In addition, the substation 102 comprises an arrangement with which the processing unit 112 controls 113 the transmission of the transmitter unit 111.

Fig. 2 shows a prior-art time division duplex arrangement for transmitting data in point-to-multipoint connections. A central station 101 comprises a processing unit 103, transmitter unit 107, receiver unit 104 and an antenna 106. Additionally in a time division duplex system there is between the antenna 106 and transmitter unit 107 as well as receiver unit 104 a switch element 201 to control the transmission and reception of signals. In the central station 101 the processing unit 103 is arranged so as to control 203 the operation of the transmitter unit 107 and the switch element 201. A prior-art substation 102 in a time division duplex system comprises an antenna 108, switch element 202, transmitter unit 111, receiver unit 110 and a processing unit 112. The processing unit 112 controls 204 the receiver unit 110 and switch element 202 in the substation 102 so that transmission occurs in the right time slot. When using the time division duplex arrangement, only one frequency is

needed to convey the data since the transmission and reception are arranged so as to take place in different time slots.

Arrangements in accordance with Figs. 1 and 2 are used at microwave frequencies such as 2 GHz and higher. Such prior-art arrangements are used at frequencies of up to several tens of GHz.

Both the frequency division duplex and the time division duplex system have drawbacks in point-to-multipoint systems implemented in the microwave region. The biggest disadvantage of the frequency division duplex system is that it requires filters, which are expensive components. In the microwave region, signal conductors, i.e. waveguides and filters, are relatively large mechanical structures that have to be machined at very small tolerances. The pass bands of filters must be made quite narrow so that the transition from the pass band to the stop band be steep enough. Moreover, the gap between the frequency bands of the uplink and downlink directions is typically quite narrow, which adds to the steepness required of the filter. Therefore, the pass band of a steep enough filter typically does not suffice to cover the whole frequency band used by the system. Thus, in order to cover the various sub-bands the radio apparatuses of radio link systems must be implemented in several different versions. So, versions are installed for the central and substations according to the operating frequency. Especially it may be required that several parallel transceiver units adapted to the different sub-bands be installed at the central stations in accordance with the operating frequencies used.

This kind of an arrangement is naturally very expensive. The continual expansion of broadband data transmission and mobile communication systems adds to the need for microwave links, too, whereby it is obvious that simpler and less expensive solutions are needed to realize point-to-multipoint connections. In this patent application microwave frequencies refer to 2 GHz and higher frequencies.

Use of expensive filters can be avoided by means of the time division duplex arrangement mentioned above. However, compared to the frequency division duplex arrangement the time division duplex arrangement has its own disadvantages. Compared to a solution based on separate transmission and reception frequencies a time division duplex system achieves only half of the transmission rate of the frequency division duplex system, as the time has to be divided between transmission and reception. This disadvantage can be alleviated by using higher data rates but this, in turn, makes the apparatuses more complex since the clock fre-

Claims

1. A data transmission method of a radio link system between a central station (101) and at least one substation (102), **characterized** in that
 - the central station transmits a time division multiplex signal at a first frequency,
 - 5 - the central station receives signals of said at least one substation at a second frequency, said second frequency being a different frequency than said first frequency and said signals of said at least one substation at said second frequency forming a time division multiple access signal,
 - each of said at least one substation receives substantially at said first frequency
 - 10 during certain first time periods corresponding to the substation in question, and
 - each of said at least one substation transmits substantially at said second frequency during certain second time periods corresponding to the substation in question, whereby said first time periods are different time periods than said second time periods.
- 15 2. A data transmission method according to claim 1, **characterized** in that the central station controls the time periods used for transmission and reception by the substations.
3. A radio link system comprising a central station (101) and at least one substation (102), **characterized** in that
 - 20 the central station comprises means for discriminating reception signals from transmission signals on the basis of frequency,
 - and in that the central station is arranged so as to transmit a time division multiplex signal at a first frequency and receive a time division multiple access signal at a second frequency,
 - 25 and in that the substation is arranged so as to receive substantially at said first frequency during certain first time periods corresponding to the substation in question and to transmit substantially at said second frequency during certain second time periods corresponding to the substation in question, whereby said first and second time periods are different time periods and signals transmitted by said at
 - 30 least one substation at said second frequency are arranged to form said time division multiple access signal.
4. A radio link system according to claim 3, **characterized** in that the central station is adapted so as to select said first and second time periods.
5. A radio link system according to claim 3, **characterized** in that it is located in

a GSM mobile communication system.

6. A radio link system according to claim 3, **characterized** in that it is located in a UMTS mobile communication system.
7. A radio link system according to claim 3, **characterized** in that it is located in
5 a broadband data transmission system.
8. A radio link system according to claim 7, **characterized** in that it is located in a LMDS system.
9. A radio link system according to claim 7, **characterized** in that it is located in a HiperAccess system.

9/913 893

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

REVISED VERSION

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 September 2000 (14.09.2000)

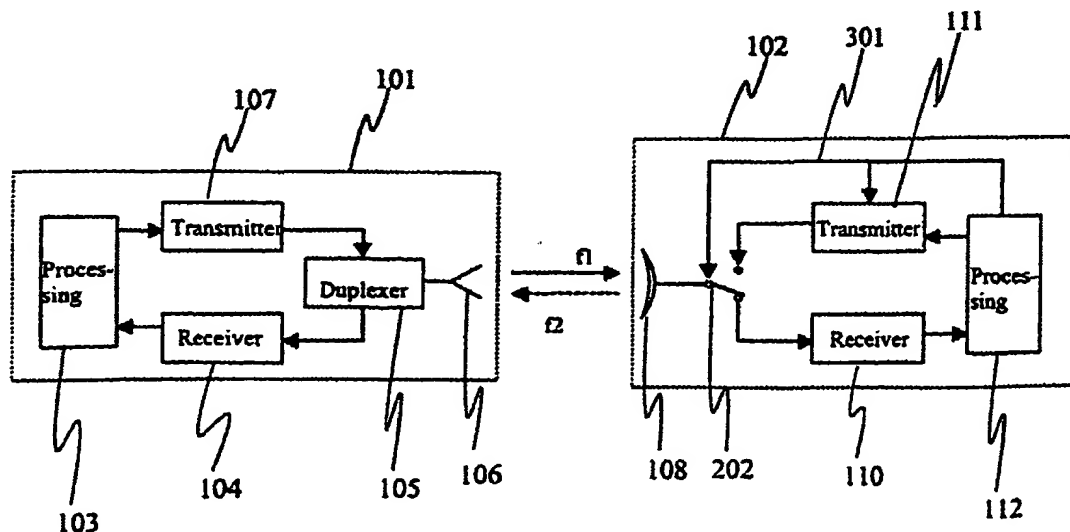
PCT

(10) International Publication Number
WO 00/54434 A1

- (51) International Patent Classification⁷: H04B 7/24, (74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).
H04Q 7/20
- (21) International Application Number: PCT/FI00/00174 (81) Designated States (*national*): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 6 March 2000 (06.03.2000)
- (25) Filing Language: Finnish
- (26) Publication Language: English
- (30) Priority Data: 990483 5 March 1999 (05.03.1999) FI (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): NOKIA NETWORKS OY [FI/FI]; P.O. Box 300, FIN-00045 Nokia Group (FI).
- (72) Inventor; and Published:
— with international search report
- (75) Inventor/Applicant (*for US only*): MÄKINEN, Jarmo (88) Date of publication of the revised international search report: 15 November 2001
[FI/FI]; Vahverotie 5 D, FIN-02730 Espoo (FI).

[Continued on next page]

(54) Title: DATA TRANSMISSION METHOD AND RADIO LINK SYSTEM



(57) Abstract: This invention relates to data transmission in a microwave link system particularly through point-to-multipoint connections. The arrangement according to the invention utilizes both frequency and time division duplex arrangement to simplify substation structures. In accordance with the invention a substation transmits at different times than it receives, and uses different frequencies for the transmission and reception. The central station, in turn, includes a duplexer unit, whereby it can both transmit and receive simultaneously when the transmission and reception frequencies are sufficiently apart. Such an arrangement achieves advantages of the time division duplex arrangement, such as e.g. an inexpensive substation structure, without the drawbacks related to the time division duplex arrangement.

WO 00/54434 A1

Pat. Available C



(15) Information about Correction:

see PCT Gazette No. 46/2001 of 15 November 2001, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00174

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/24, H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9721287 A1 (ADVANCED MICRO DEVICES, INC.), 12 June 1997 (12.06.97), page 2 - line 34; page 4 - line 16 --	1-9
X	US 5617412 A (M.DELAPRAT ET AL), 1 April 1997 (01.04.97), column 6, line 4 - line 13; column 1, line 38 - line 39 --	1,3,5,6
X,P	WO 9926437 A1 (ERICSSON INC.), 27 May 1999 (27.05.99), page 3, line 18 - line 24; page 3, line 24 - page 4, line 2, abstract --	1-4

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

19 July 2000

Date of mailing of the international search report

10-07-2001

Name and mailing address of the ISA/

Swedish Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00174

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5689502 A (L. SCOTT), 18 November 1997 (18.11.97), column 8, line 59 - column 9, line 10 -- -----	1,3

INTERNATIONAL SEARCH REPORT

Information on patent family members

05/02/01

International application No.

PCT/FI 00/00174

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
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				US	5956326 A	21/09/99
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				EP	0873593 A	28/10/98
				IL	118447 D	00/00/00
				WO	9639749 A	12/12/96

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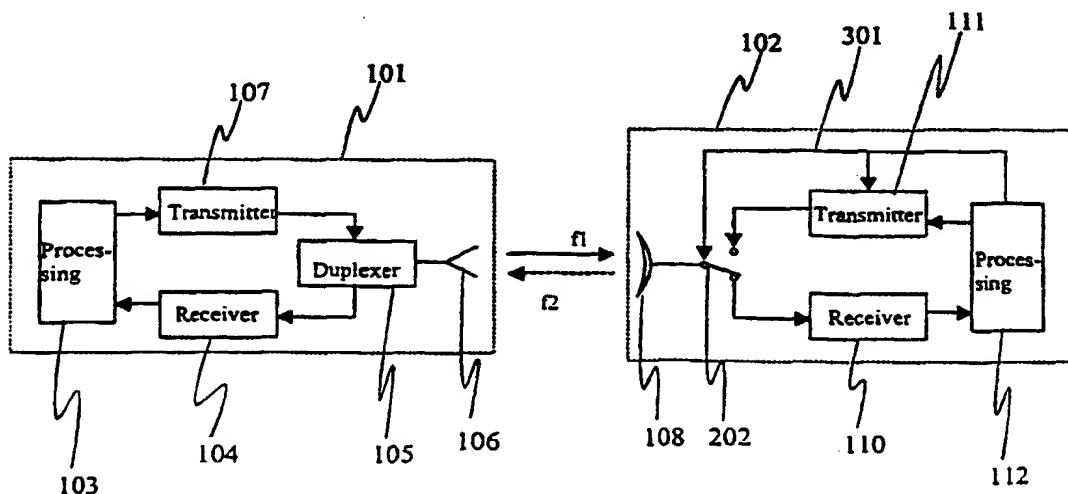
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04B 7/24, H04Q 7/20		A1	(11) International Publication Number: WO 00/54434
			(43) International Publication Date: 14 September 2000 (14.09.00)
(21) International Application Number: PCT/FI00/00174 (22) International Filing Date: 6 March 2000 (06.03.00) (30) Priority Data: 990483 5 March 1999 (05.03.99) FI (71) Applicant (for all designated States except US): NOKIA NETWORKS OY [FI/FI]; P.O. Box 300, FIN-00045 Nokia Group (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): MÄKINEN, Jarmo [FI/FI]; Vahverotie 5 D, FIN-02730 Espoo (FI). (74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).			(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Finnish).</i>

(54) Title: DATA TRANSMISSION METHOD AND RADIO LINK SYSTEM



(57) Abstract

This invention relates to data transmission in a microwave link system particularly through point-to-multipoint connections. The arrangement according to the invention utilizes both frequency and time division duplex arrangement to simplify substation structures. In accordance with the invention a substation transmits at different times than it receives, and uses different frequencies for the transmission and reception. The central station, in turn, includes a duplexer unit, whereby it can both transmit and receive simultaneously when the transmission and reception frequencies are sufficiently apart. Such an arrangement achieves advantages of the time division duplex arrangement, such as e.g. an inexpensive substation structure, without the drawbacks related to the time division duplex arrangement.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00174

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/24, H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5617412 A (M. DELPRAT ET AL.), 1 April 1997 (01.04.97), column 6, line 4 - line 13; column 1, line 38 - line 39 --	1,3,5,6
X,P	WO 9926437 A1 (ERICSSON INC.), 27 May 1999 (27.05.99), page 3, line 18 - line 24; page 3, line 24 - page 4, line 2, abstract --	1-4
A	US 5689502 A (L. SCOTT), 18 November 1997 (18.11.97), column 8, line 59 - column 9, line 10 -- -----	1,3

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☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

19 July 2000

Date of mailing of the international search report

27-07-2000

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Swedish Patent Office

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Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

02/12/99

International application No.

PCT/FI 00/00174

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
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US	5689502	A	18/11/97	AU	6025796 A	24/12/96
				BR	9608548 A	06/07/99
				CA	2223321 A	12/12/96
				CN	1192300 A	02/09/98
				EP	0873593 A	28/10/98
				IL	118447 D	00/00/00
				WO	9639749 A	12/12/96

PCT REQUEST

Original (for SUBMISSION) - printed on 06.03.2000 01:23:56 PM

49488

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	49488
I	Title of invention	DATA TRANSMISSION METHOD AND RADIO LINK SYSTEM
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA NETWORKS OY
II-5	Address:	P.O. Box 300 FIN-00045 Nokia Group Finland
II-6	State of nationality	FI
II-7	State of residence.	FI
II-8	Telephone No.	+358-9-51121
II-9	Facsimile No.	+358-9-51168080
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	MÄKINEN, Jarmo
III-1-5	Address:	Vahverotie 5 D FIN-02730 Espoo Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	BERGGREN OY AB
IV-1-2	Address:	P.O. Box 16 FIN-00101 Helsinki Finland
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IV-1-4	Facsimile No.	+358-9-6933944
IV-1-5	e-mail	email.box@berggren.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>

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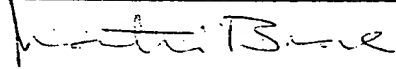
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application		
VI-1-1	Filing date	05 March 1999 (05.03.1999)	
VI-1-2	Number	990483	
VI-1-3	Country	FI	
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	9	-
VIII-3	Claims	2	-
VIII-4	Abstract	1	49488.txt
VIII-5	Drawings	2	-
VIII-7	TOTAL	18	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-10	Copy of general power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of Official Action in FI 990483	-
VIII-18	Figure of the drawings which should accompany the abstract	3	
VIII-19	Language of filing of the international application	Finnish	

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IX-1	Signature of applicant or agent	
IX-1-1	Name	BERGGREN OY AB
IX-1-2	Name of signatory	Matti Brax
IX-1-3	Capacity	Patent Agent

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10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the record copy by the International Bureau	
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PCT (ANNEX - FEE CALCULATION SHEET)

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(This sheet is not part of and does not count as a sheet of the international application)

0	For receiving Office use only		
0-1	International Application No.		
0-2	Date stamp of the receiving Office		
0-4	Form - PCT/RO/101 (Annex)		
0-4-1	PCT Fee Calculation Sheet Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)	
0-9	Applicant's or agent's file reference	49488	
2	Applicant	NOKIA NETWORKS OY, et al.	
12	Calculation of prescribed fees	fee amount/multiplier	total amounts (FIM)
12-1	Transmittal fee T	⇒	800
12-2	Search fee S	⇒	5 618
12-3	International fee Basic fee (first 30 sheets) b1	2 431.8	
12-4	Remaining sheets	0	
12-5	Additional amount (X)	53.51	
12-6	Total additional amount b2	0	
12-7	b1 + b2 = B	2 431.8	
12-8	Designation fees Number of designations contained in international application	83	
12-9	Number of designation fees payable (maximum 8)	8	
12-10	Amount of designation fee (X)	523.22	
12-11	Total designation fees D	4 185.76	
12-12	PCT-EASY fee reduction R	-749.16	
12-13	Total International fee (B+D-R) I	⇒	5 868.4
12-14	Fee for priority document Number of priority documents requested	1	
12-15	Fee per document (X)	422	
12-16	Total priority document fee P	⇒	422
12-17	TOTAL FEES PAYABLE (T+S+I+P)	⇒	12 708.4
12-19	Mode of payment	cheque	

VALIDATION LOG AND REMARKS

13-2-1	Validation messages Request	Green? A translation of the international application into English will have to be prepared under the responsibility of the ISA selected.
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PCT (ANNEX - FEE CALCULATION SHEET)

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		Green? Please note that the entire request (including the title of invention) must be in English
13-2-4	Validation messages Priority	Yellow! Priority 1: The twelve-month time limit for claiming priority would appear to have expired. Please verify.
13-2-6	Validation messages Contents	Green? Reference number for attached copy of general power of attorney not indicated.
13-2-7	Validation messages Fees	Green? Please verify that modified fee amounts are correct.

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Green?	Please note that the entire request (including the title of invention) must be in English
Yellow!	Priority Priority 1: The twelve-month time limit for claiming priority would appear to have expired. Please verify.
Green?	Contents Reference number for attached copy of general power of attorney not indicated.
Green?	Fees Please verify that modified fee amounts are correct.

Before submitting the International Application, please carefully verify that:

- the information contained on printed Request form is correct;
- Box IX of the Request form has been signed;
- all elements of the international application as indicated in Box VIII of the Request form have been attached; and,
- the diskette containing the PCT-EASY zip file of the International Application has been enclosed and has been clearly labeled "PCT-EASY", with the applicant's or agent's file reference, and the first applicant's name.

ATTENTION

DO NOT modify any indications on the Request form printout. The attached PCT-EASY application has been locked. If an error or an omission is discovered at this time, you must copy the submitted application as a template and make the change or correction in a new application (using the submitted application as a template). You may create such a template by copying the submitted application from the "Stored Forms" folder to the "New PCT Forms" folder. Open the new (.0WO) file created in the "New PCT Forms" folder, correct the errors and proceed with the submission process again.

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0	For receiving Office use only	
0-1	International Application No.	PCT/FI 0 0 / 0 0 1 7 4
0-2	International Filing Date	0 6 MAR 2000 (0 6 -03- 2000)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	49488
I	Title of invention	DATA TRANSMISSION METHOD AND RADIO LINK SYSTEM
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA NETWORKS OY
II-5	Address:	P.O. Box 300 FIN-00045 Nokia Group Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358-9-51121
II-9	Facsimile No:	+358-9-51168080
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	MÄKINEN, Jarmo
III-1-5	Address:	Vahverotie 5 D FIN-02730 Espoo Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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IV-1-2	Address:	P.O. Box 16 FIN-00101 Helsinki Finland
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V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

PCT REQUEST

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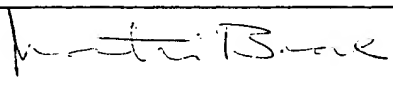
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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	05 March 1999 (05.03.1999)
VI-1-2	Number	990483
VI-1-3	Country	FI
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)
VIII	Check list	number of sheets electronic file(s) attached
VIII-1	Request	4 -
VIII-2	Description	9 -
VIII-3	Claims	2 -
VIII-4	Abstract	1 49488.txt
VIII-5	Drawings	2 -
VIII-7	TOTAL	18
	Accompanying items	paper document(s) attached electronic file(s) attached
VIII-8	Fee calculation sheet	✓ -
VIII-9	Separate signed power of attorney	✓ -
VIII-10	Copy of general power of attorney	✓ -
VIII-16	PCT-EASY diskette	- diskette
VIII-17	Other (specified):	Copy of Official Action in FI 990483 -
VIII-18	Figure of the drawings which should accompany the abstract	3
VIII-19	Language of filing of the international application	Finnish

PCT REQUEST

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IX-1	Signature of applicant or agent	
IX-1-1	Name	BERGGREN OY AB
IX-1-2	Name of signatory	Matti Brax
IX-1-3	Capacity	Patent Agent

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10-1	Date of actual receipt of the purported international application	0 6 MAR 2000	(0 6 -03- 2000)
10-2	Drawings:		
10-2-1	Received		
10-2-2	Not received		
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10-5	International Searching Authority	ISA/SE	
10-6	Transmittal of search copy delayed until search fee is paid		

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11-1	Date of receipt of the record copy by the International Bureau	2 9 MARCH 2000	(2 9. 03. 00)
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Tiedonsiirtomenetelmä ja radiolinkkijärjestelmä

Tämä keksintö koskee tiedonsiirtoa mikroaaltolinkkijärjestelmässä erityisesti point-to-multipoint-yhteyksien avulla.

- 5 Point-to-multipoint-järjestelyllä (PMP) tarkoitetaan tässä järjestelyä, jossa keskus-
asemalta on yhteys useampaan ala-asemaan. Tällaista järjestelyä käytetään esimer-
kiksi matkaviestinjärjestelmien tukiasemien yhdistämiseksi matkaviestinverkkoon,
jolloin useampi matkaviestimiä palveleva tukiasema on point-to-multipoint-yhtey-
dessä useaa tukiasemaa palvelevan keskusase-
man kanssa. Tällaisen järjestelyn avul-
10 la jokaiselle tukiasemalle ei tarvitse järjestää kiinteätä signaalijohdotusta, mikä on
suuri etu erityisesti kaupunkiympäristössä, missä tukiasemia on tiheässä ja missä
kaapeleiden asentaminen on työlästä ja kallista.

- Point-to-multipoint-järjestelmissä käytetään tavallisesti niin kutsuttua taajuusjakois-
ta (FDD; Frequency Division Duplex) järjestelyä, jossa ylä- ja alasuuntien signaalit
15 välitetään eri taajuuksilla, jolloin eri suuntien signaalit voidaan erottaa toisistaan
taajuuden perusteella.

- Myös aikajakoista (TDD; Time Division Duplex) järjestelmää käytetään point-to-
multipoint-yhteyksissä. Aikajakoisessa järjestelmässä keskusasemalle ja ala-ase-
malle on jaettu yhteinen liikennöintikanava, jota keskusase-
ma ja ala-asema tai ala-
20 asemat käyttävät ajallisesti eri aikaan.

- Järjestelyjä, jossa useampi lähettävä osapuoli lähettää samalla kanavalla signaaleja
siten, että lähetteet erotetaan toisistaan lähetyshetken perusteella, kutsutaan yleisesti
aikajakomonikäyttöisiksi järjestelyiksi (TDMA, time division multiple access).
Point-to-multipoint-yhteyksissä tyypillisesti käytettävät järjestelyt ovat siten ylä-
25 suunnan liikennöinnissä TDMA-järjestelyjä. Edellä kuvattua taajuusjakoista järjes-
telyä voidaan siten kutsua FDD-TDMA-järjestelyksi, koska siinä ylä- ja alasuunnan
signaalit erotetaan taajuuden perusteella, mutta yläsuunnan signaalit toisistaan ajan
perusteella. Edellä kuvattua aikajakoista PMP-järjestelyä voidaan vastaavaksi kutsua
TDD-TDMA-järjestelyksi.

- 30 Myös muuntyyppisiä monikäyttöjärjestelyjä tunnetaan. Esimerkiksi FDMA-järjes-
telyssä (frequency division multiple access) samalla signaalitiellä kulkevat lähetteet
erotetaan toisistaan taajuuden avulla. Edellä kuvatussa yhden keskusase-
man ja
useamman ala-aseman esimerkissä FDMA-järjestely vastaisi sitä, että ala-asemat lä-

hettävät keskusasemalle kukin omalla taajuudellaan, jolloin keskusase-
ma erottamaan eri ala-asemien signaalit toisistaan niiden lähetystaajuuden perusteella.
Koodijakoisessa monikäyttöjärjestelyssä (CDMA, code division multiple access)
samalla signaalitiellä kulkevat lähetteet erotetaan toisistaan hajotuskoodien avulla.

5 Kuvassa 1 on esitetty tekniikan tason mukainen point-to-multipoint-yhteyksissä
käytettävä taajuusjakoinen järjestely ylä- ja alasuunnan erottamiseksi. Keskusasema
101 käsittää prosessointiyksikön 103 kantataajuuskaistan prosessoimiseksi. Lähetin-
yksikössä 107 ja vastaanotinyksikössä 104 hoidetaan signaalien lähettämiseen ja
vastaanottamiseen liittyviä toimintoja. Dupleksointiyksikkö 105 kytkee sekä läheti-
10 nyksikön 107 että vastaanotinyksikön 104 antenniin siten, että ne voivat lähettää tai
vastaanottaa signaaleja yhden antennin 106 kautta. KytKentä tapahtuu siten, että
jollakin tietyllä taajuudella dupleksointiyksikkö 105 kytkee lähetinyksikön 111 an-
tenniin 106 ja jollakin toisella tietyllä taajuudella dupleksointiyksikkö 105 kytkee
vastaanotinyksikön 104 antenniin 106. Dupleksointiyksikkö toteutetaan tavanomai-
15 sesti suodattimien avulla. Vastaavasti ala-asemaan 102 on järjestetty vastaavat yksi-
köt signaalien vastaanottamiseksi ja lähettämiseksi. Ala-asema 102 käsittää antennin
108, dupleksointiyksikön 109, lähetinyksikön 111, vastaanotinyksikön 110 sekä pro-
sessointiyksikön 112. Kuvan mukaisessa järjestelyssä keskusase-
ma 101 ja ala-asema 102 käyttävät kahta eri taajuutta f1; f2 signaalien välittämiseksi. Saman keskusase-
20 man 101 kanssa liikennöivät ala-asemat 102 käyttävät kaikki olennaisesti samaa lä-
hetystaajuutta liikennöidessään keskusase-
man 101 kanssa. Ala-asemassa 102 on li-
säksi järjestely, jolla prosessointiyksikkö 112 ohjaa 113 lähetinyksikön 111 lähety-
stä.

Kuvassa 2 on esitetty tekniikan tason mukainen point-to-multipoint-yhteyksissä
25 käytettävä järjestelmä, joka käyttää aikajakoista järjestelyä datan välittämiseksi.
Keskusasema 101 käsittää prosessointiyksikön 103, lähetinyksikön 107, vastaanoti-
nyksikön 104 sekä antennin 106. Lisäksi aikajakoisessa järjestelmässä on antennin
106 ja lähetinyksikön 107 sekä vastaanotinyksikön 104 väliin järjestetty kytkinelin
201, jonka avulla voidaan ohjata signaalien lähetystä ja vastaanottoa. Keskusase-
30 massa 101 prosessointiyksikkö 103 on järjestetty ohjaamaan 203 lähetinyksikön 107
sekä kytkinelimen 201 toimintaa. Tekniikan tason mukainen ala-asema 102 aikaja-
koisessa järjestelmässä käsittää antennin 108, kytkinelimen 202, lähetinyksikön 111,
vastaanotinyksikön 110 ja prosessointiyksikön 112. Prosessointiyksikkö 112 ohjaa
204 vastaavasti ala-aseman 102 vastaanotinyksikköä 110 ja kytkinelintä 202, jotta
35 lähetys tapahtuu oikeassa aikavälissä. Aikajakoista järjestelyä käytettäessä riittää

yksi taajuus datan välittämiseen, koska lähetys ja vastaanotto on järjestetty tapahtumaan eri aikaväleissä.

5 Kuvien 1 ja 2 kaltaisia järjestelyjä käytetään mikroaaltotaajuuksilla, kuten esimerkiksi 2 GHz ja sitä suuremmilla taajuuksilla. Tällaisia tunnetun tekniikan mukaisia järjestelyjä hyödynnetään useiden kymmenien GHz taajuuksiin asti.

10 Sekä taajuusjakoisessa että aikajakoisessa järjestelmässä on huonoja puolia mikroaaltoalueella toteutetuissa point-to-multipoint-järjestelmissä. Taajuusjakoisen järjestelmän suurin haitta on se, että kyseisessä järjestelyssä tarvitaan suodattimia, jotka ovat kalliita komponentteja. Mikroaaltoalueella signaalihoitimet eli aaltoputket ja suodattimet ovat suhteellisen suurikokoisia mekaanisia rakenteita, jotka on työstettävä hyvin pienillä toleransseilla. Suodatinten päästökaistat on tehtävä varsin kapeiksi, jotta siirtymä päästökaistalta estokaistalle saataisiin riittävän jyrkäksi. Ylä- ja alasuunnille tarkoitettujen taajuuskaistojen väli on tyypillisesti vielä varsin kapea, mikä lisää suodattimelta vaadittavaa jyrkkyyttä. Tämän vuoksi riittävän jyrkän suotimen päästökaista ei tyypillisesti riitä kattamaan koko järjestelmän käytössä olevaa taajuuskaistaa. Tästä johtuen radiolinkkijärjestelmien radiolaitteistoja on toteutettava useampana eri versiona eri osakaistojen peittämiseksi. Keskus- ja ala-asemille siten asennetaan käyttötaajuuden mukaiset versiot. Erityisesti keskusasemille voidaan joutua asentamaan useampiakin rinnakkaisia eri osakaistoille sovitettuja lähettin-vastaanotinyksiköitä käytettyjen toimintataajuuksien mukaan.

25 Tällainen järjestely on luonnollisesti hyvin kallis. Laajakaistaisen datansiirtojärjestelmän ja matkaviestinjärjestelmien jatkuvan kasvun takia mikroaaltolinkkien tarve kasvaa, minkä vuoksi alalla selkeästi tarvitaan yksinkertaisempia ja halvempia ratkaisuja point-to-multipoint-yhteyksien toteuttamiseen. Tässä hakemuksessa mikroaaltotaajuuksilla tarkoitetaan tässä hakemuksessa 2 GHz ja sitä suurempia taajuuksia.

30 Kalliiden suodattimien käyttö voidaan välttää edellä mainitun aikajakoisen järjestelyn avulla. Aikajakoisella järjestelyllä on kuitenkin omat haittapuolensa verrattuna taajuusjakoiseen järjestelyyn. Erillisiä lähetys- ja vastaanottotaajuuksia käyttävään ratkaisuun verrattuna aikajakoisessa järjestelmässä saavutetaan vain puolet taajuusjakoisen järjestelmän siirtonopeudesta, koska aika on jaettava lähetyksen ja vastaanoton kesken. Tätä haittaa voidaan lieventää käyttämällä suurempia datansiirtonopeuksia, mutta tämä taas monimutkaistaa laitteiden rakennetta, koska datansiirtoelimien kellotaajuutta on nostettava. Aikajakoinen järjestelmä on ongelmallinen myös sellaisessa varsin tavallisessa tapauksessa, jossa yhden keskusase-

sema alue on jaettu toisistaan erillisiin sektoreihin. Tällöin keskusasemalla on yksi lähetin-vastaanotin-laitteisto kutakin sektoria kohti. Tällaisessa tapauksessa eri sektoreiden lähetys- ja vastaanottojaksot on synkronoitava tai valittava käytetyt taajuu-

5 sektorin vastaanottoa keskusasemalla. Keskusaseman eri sektoreiden lähettimien ja vastaanottimien lyhyen välimatkan takia synkronoimattomassa tapauksessa lähetyksen aiheuttama häiriö on hyvin voimakas, elleivät lähetyksessä ja vastaanotossa käytetyt taajuu-

10 Tämän keksinnön tavoitteena on poistaa edellä esitetyt tekniikan tason mukaiset ongelmat. Tämän keksinnön tavoitteena on myös toteuttaa radiolinkkijärjestelmä, joka on tekniikan tason mukaisia ratkaisuja halvempi ja yksinkertaisempi.

Nämä tavoitteet saavutetaan järjestämällä keskusase- lähettämään TDM-signaalia eli multipleksattua signaalia ensimmäisellä taajuudella ja vastaanottamaan ala-ase-

15 mien lähetitteitä toisella taajuudella, ja järjestämällä kukin ala-ase- toimimaan aika- ja taajuusjakoisesti eli vastaanottamaan tiettyinä ensimmäisinä ajanjaksoina mainitulla ensimmäisellä taajuudella ja lähettämään tiettyinä toisina, mainituista ensimmäisistä ajanjaksoista eroavina ajanjaksoina mainitulla toisella taajuudella.

Keksinnön mukaiselle tiedonsiirtomenetelmälle on tunnusomaista se, mitä on mai-

20 nittu itsenäisen menetelmään kohdistuvan patenttivaatimuksen tunnusosassa. Keksinnön mukaiselle radiolinkkijärjestelmälle on tunnusomaista se, mitä on mainittu itsenäisen radiolinkkijärjestelmään kohdistuvan patenttivaatimuksen tunnusosassa. Alivaatimukset kuvaavat keksinnön erilaisia edullisia toteutusmuotoja.

Keksinnön mukaisessa järjestelyssä käytetään sekä taajuus- että aikajakoista järjeste-

25 lyä ala-ase- rakenteiden yksinkertaistamiseksi. Keksinnön mukaisesti ala-ase- lähettää eri aikana kuin se vastaanottaa, ja käyttää lähetykseen ja vastaanottoon eri taajuuksia. Keskusasema puolestaan on varustettu dupleksointiyksiköllä, jolloin se voi sekä lähettää että vastaanottaa samanaikaisesti, kun lähetys- ja vastaanottotaajuu-

30 juudet ovat riittävästi toisistaan eroavat. Tällaisella järjestelyllä saavutetaan aikajakoisen järjestelyn etuja, kuten esimerkiksi halpa ala-ase- rakenne, ilman aikajakoisen järjestelyn aiheuttamia haittoja.

Seuraavassa keksintöä selostetaan viittaamalla oheisiin kuviin, joissa

kuva 1 esittää erästä tekniikan tason mukaista järjestelyä,

- kuva 2 esittää erästä toista tekniikan tason mukaista järjestelyä,
kuva 3 esittää erästä keksinnön mukaista ratkaisua,
kuva 4 esittää erästä keksinnön mukaista verkkojärjestelyä ja
kuva 5 esittää erään keksinnön mukaisen ratkaisun aikavälijärjestelyä.

- 5 Kuvia 1 ja 2 on selostettu edellä tekniikan tason kuvauksen yhteydessä. Kuvissa käytetään toisistaan vastaavista osista samoja viitenumeroita ja -merkintöjä.

Kuvassa 3 on esitetty eräs keksinnön edullinen suoritusmuoto. Kuvassa 3 on esitetty sekä keskusaseaman 101 että ala-aseman 102 rakenne. Tässä esimerkinomaisessa keksinnön mukaisessa ratkaisussa keskusaseama 101 käsittää kantataajuusosan pro-
10 sessointiyksikön 103, joka mm. tuottaa kantataajuisen moduloidun signaalin lähetinyksikköä 107 varten ja käsittelee vastaanotinyksikön 104 tuottaman kantataajuisen signaalin. Prosessointiyksikkö 103 ohjaa lähetinyksikköä 107, joka lähetinyksikkö 107 välittää lähetettävän datan dupleksointiyksikön 105 kautta antennille 106. Vas-
15 taanottoa varten keskusasemassa 101 on vastaanotinyksikkö 104, joka on kytketty antenniin 106 dupleksointiyksikön 105 välityksellä. Dupleksointiyksikkö 105 käsit-
20 tää suodattimen antennin kytkemiseksi vastaanotinyksikköön 104 vastaanottotaajuuskaistalla ja suodattimen antennin kytkemiseksi lähetystaajuuskaistalla lähetinyksikköön. Keksinnön mukaisessa järjestelyssä keskusaseama 101 lähettää ensimmäisellä taajuudella f_1 ja vastaanottaa toisella taajuudella f_2 , jotka ensimmäinen ja
25 toinen taajuus ovat eri taajuuksia. Keskusaseama lähettää aikajakoista signaalia (TDM, Time Division Multiplex), jossa eri ala-asemille tarkoitetut läheteet ovat eri aikajaksoina. Keskusyksikössä 101 voi olla leveiden lähetys- ja vastaanottotaajuuskaistojen peittämiseksi useita rinnakkaisille taajuuskaistoille sovitettuja mikroaalto-
30 osia, jotka kukin käsittävät ainakin antennin 106, dupleksointiyksikön 105, lähetimen 107 ja vastaanottimen 104. Kuvassa 3 esitetään nämä elimet selvyiden vuoksi vain kerran.

Ala-asema 102 käsittää ainakin antennin 108, kytkinelimen 202, lähetinyksikön 111, vastaanotinyksikön 110 ja kantataajuusosan prosessointiyksikön 112. Keksinnön mukaisessa järjestelyssä ala-asemat vastaanottavat ensimmäisellä taajuudella f_1 ja
30 lähettävät toisella taajuudella f_2 . Kytkinelin 202 kytkee lähetinyksikön 111 antenniin 108 lähetyksen ajaksi ja vastaanotinyksikön 110 antenniin 108 vastaanoton ajaksi. Kantataajuusosan prosessointiyksikkö 112 tai muu ala-aseman ohjausyksikkö ohjaa kytkimen 202 toimintaa. Kantataajuusosan prosessointiyksikkö 112 lisäksi mm. tuottaa kantataajuisen moduloidun signaalin lähetinyksikköä 111 varten ja käsittelee

vastaanotinyksikön 110 tuottaman kantataajuisen signaalin. Ala-asema vastaanottaa taajuudella f1 muulloin kuin oman lähetysvuoronsa aikana. Keksinnön mukaisessa järjestyksessä ala-asema siten käyttää kaksitaajuista aikajakoista liikennöintiä. Keskus-
5 saseja järjestää ala- ja yläsuunnan tiedonsiirtoon käytetyt aikavälit ala-asemakoh-
taisesti siten, että yhdenkään ala-aseman ei tarvitse lähtää ja vastaanottaa samanai-
kaisesti. Keskusasema on siten sovitettu valitsemaan ala-asemien käyttämät aikavä-
lit.

Keksinnön eri toteutusmuodoissa laiterakenteet voivat olla muunkinlaisia kuin mitä
kuvassa 3 on esitetty. Esimerkiksi, eräässä keksinnön edullisessa toteutusmuodossa
10 keskusasemalla ei ole dupleksointiyksikköä, vaan keskusasemassa on vastaanottoa ja
lähetystä varten erilliset antennit. Lähetyks- ja vastaanottosignaali voidaan tällaisessa
rakenteessa erottaa toisistaan ainakin osittain lähetyks- ja vastaanottoantennien mitoi-
tuksen perusteella. Tällaisessa toteutusmuodossa vastaanotinhaarassa on edullisesti
15 vastaanottosuodin lähetesignaalin suodattamiseksi ja erottamiseksi vastaanotettavas-
ta signaalissa. Lähetinhaarassa voidaan edullisesti myös käyttää suodatusta lähetti-
men synnyttämän kohinan rajoittamiseksi vastaanottimen taajuuskaistalla. Tällais-
sakin sovellusmuodossa lähetyks- ja vastaanottosignaali erotetaan keskusasemalla
toisistaan taajuuden perusteella.

Siten yhteistä keksinnön eri toteutusmuodoille on ainakin se, että keskusaseja käsi-
20 tää ainakin välineet vastaanottosignaalin erottamiseksi lähetesignaaleista taajuuden
perusteella. Edullisesti taajuuden perusteella erotus voidaan toteuttaa suodatineli-
min avulla. Lisäksi taajuuden perusteella erotus voidaan toteuttaa ainakin osaksi lä-
hetin- ja vastaanotinantennien mitoituksella sellaisissa sovellusmuodoissa, joissa
käytetään erillisiä antennia lähetykseen ja vastaanottoon.

Keksinnön eri toteutusmuodoissa voidaan ala-asemien aikajakoinen järjestely toteut-
taa myös muulla tavoin kuin kytkemällä antenni kytkineliimin avulla lähetyksvuoron
ajaksi lähettimeen ja vastaanottovuoron ajaksi vastaanottimeen. Esimerkiksi, keksin-
nön eräässä edullisessa toteutusmuodossa ala-aseman lähettimellä ja vastaanottimel-
la on erilliset antennit. Tällaisessa toteutusmuodossa voidaan aikajakoinen järjestely
30 toteuttaa kytkemällä lähetin jollain sopivalla tavalla pois toiminnasta vastaanotto-
vuoron ajaksi.

Tarkastellaan seuraavaksi keksinnön mukaisen järjestyksen toimintaa kuvassa 4 ha-
vainnollistamassa esimerkinomaisessa tilanteessa, jossa saman keskusasejan C, 101
kanssa liikennöi kolme ala-asemaa 102,R1,R2,R3. Keskusasema lähettää ala-ase-
35 mille taajuudella f1, ja ensimmäiselle ala-asemalle R1 ajanjaksona td1, toiselle ala-

- asemalle R2 ajanjaksona td2, ja kolmannelle ala-asemalle R3 ajanjaksona td3. Ala-
asemat vuorostaan lähettävät keskusasemalle taajuudella f2, ja ensimmäinen ala-
asema R1 lähettää ajanjaksona tu1, toinen ala-asema R2 ajanjaksona tu2, ja kolmas
ala-asema R3 ajanjaksona tu3. Ensimmäisen ala-aseman vastaanottoaikaväli td1 on
5 oltava eri aikaan kuin saman ala-aseman lähetyksaikaväli tu1, samoin vastaavasti
muiden ala-asemien kohdalla. Tällaisella järjestelyllä saavutetaan yhtä suuri kesku-
saseman tiedonsiirtokapasiteetti kuin tunnetun tekniikan mukaisella kaksitaajuusjär-
jestelmällä, mutta tällainen järjestely on merkittävästi helpompia toteuttaa, koska ala-
asemissa 102 ei tarvita kalliita dupleksointiyksiköitä.
- 10 Kuva 5 havainnollistaa erästä esimerkkiä lähetyksen ja vastaanoton ajoituksesta ku-
van 4 mukaisessa järjestelyssä. Kuva 5 havainnollistaa keskusase-
man C ja ala-ase-
mien R1, R2 ja R3 lähetyksaikavälejä eräänä esimerkinomaisena ajanjaksona. Kuvas-
sa 5 ruudut t1 ... t18 havainnollistavat aikavälejä. Keskusaseman C läheteessä vaa-
kaviivoituksella merkityt aikavälit on tarkoitettu ala-asemalle R3, pystyviivoituksel-
15 la merkityt aikavälit ala-asemalle R1, ja vinoviivoituksella merkityt aikavälit ala-
asemalle R2. Tyhjät ruudut ilmaisevat aikaväliä, jonka aikana kyseinen lähetin ei lä-
hetä hyötydataa. Kuvan 5 esimerkissä keskusase-
ma C lähettää ala-asemalle R3 tar-
koitettua dataa aikaväleillä t1, t2, t7, t8, t9, t17 ja t18, ala-asemalle R1 tarkoitettua
dataa aikaväleillä t3, t14 ja t15, ja ala-asemalle R2 tarkoitettua dataa aikaväleillä t4,
20 t5, t6, t12 ja t13. Vastaavasti ala-asemien kohdalla viivoitetut ruudut kuvaavat niitä
aikavälejä, joilla kyseinen ala-asema lähettää dataa keskusasemalle. Kuten kuvasta 5
havaitaan, kukin ala-asema lähettää eri aikoina kuin se vastaanottaa keskusase-
man läheteitä. Tämän vuoksi ala-aseman radio-osa voidaan toteuttaa ilman kallista dup-
leksointiyksikköä.
- 25 Kuva 5 havainnollistaa lisäksi, että eräessä keksinnön edullisessa toteutusmuodossa
ala-asemille varattujen aikavälien ei välttämättä tarvitse toistua samanlaisina. Kes-
kusase-
ma voi ohjata ala-asemia aikavälikohtaisesti, jolloin ylä- ja alasuunnan liiken-
nöntikapasiteettia voidaan käyttää eri määriä eri ala-asemille kulloisenkin liiken-
nöntitarpeen mukaan. Ylä- ja alasuunnan liikennöntikapasiteettia voidaan tällä ta-
30 voin varata toisistaan poikkeava määrä myös yhdelle ala-asemalle, kuten kuvan 5
esimerkiksi ala-asemalle R2, jolle keskusase-
ma lähettää viitenä aikavälinä, mutta jo-
ka lähettää keskusasemalle neljänä aikavälinä. Aikavälit voidaan jakaa eri ala-ase-
mille myös jollain toisella tapaa kuin mitä tässä on esitetty, kuten esimerkiksi tietyn
mittaiset vakiovuorot kullekin ala-asemalle.

Kuvan 5 esimerkissä alasuunnan yhteydessä eli keskusaseaman C läheteessä on vielä käyttämättömiä aikavälejä, tässä esimerkissä aikavälit t10, t11 ja t16. Keksinnön mukaisella järjestelyllä voidaan kuitenkin hyödyntää myös kaikki aikavälit.

- 5 Keskusasema voi ohjata ala-asemia esimerkiksi sisällyttämällä ohjauskomentoja ala-asemille suunnattuun tietovirtaan jollakin sinänsä tunnetulla tavalla.

Edellä esitetyllä keksinnön mukaisella järjestelyllä saavutetaan useita etuja. Eräs suurimpia etuja on se, että ala-asemien toteutuksessa ei tarvita eri taajuusversioita, vaan yhdellä lähetin-vastaanotin-rakenteella voidaan peittää koko käytettävä taajuuskaista. Järjestelmän toteuttajan ei siten tarvitse tuottaa eikä varastoida ala-asemien eri taajuusversioita. Point-to-multipoint-yhteyksissä ala-asemia on lisäksi useita yhtä keskusasemaa kohden, joten keksinnön mukaisen järjestelyn avulla saavutettava säästö on merkittävä. Lisäksi keksinnön mukaisella järjestelyllä saavutetaan yhtä suuri keskusaseaman tiedonsiirtokapasiteetti kuin edellä kuvatun tunnetun tekniikan mukaisen taajuusjakoisen järjestelyn avulla. Keksinnön mukaisessa järjestelyssä siten hyödynnetään aikajakoisen järjestelyn etuja ilman täysin aikajakoisen järjestelyn aiheuttamaa tiedonsiirtokapasiteetin alenemista, ja toisaalta saavutetaan silti taajuusjakoisen järjestelmän mahdollistama keskusaseaman tiedonsiirtokapasiteetti ilman datapurskenopeuden kaksinkertaistamista. Keksinnön mukaisella järjestelyllä saavutetaan muitakin taajuusjakoisen järjestelyn etuja, kuten esimerkiksi se, että keskusaseamalla keskusaseaman lähetinyksikön lähetys ei häiritse keskusaseaman vastaanotinyksikön vastaanottoa, koska dupleksointiyksikkö suodattaa lähetys- ja vastaanottosignaalit erilleen. Täten sektoroinnin toteuttaminen ja taajuuksien allokointi on helpompaa. Keksinnön mukainen järjestely soveltuu erityisen hyvin LMDS-järjestelmien (local multipoint distribution system) toteuttamiseen. Lisäksi keksinnön mukainen järjestely soveltuu parhaillaan ETSI:ssä (European Telecommunications Standards Institute) kehitteillä olevan HiperAccess -standardin mukaisiin järjestelmiin ja muihin laajakaistaisiin BRAN-verkkojärjestelmiin (Broadband Radio Access Network) sekä muihin vastaaviin laajakaistaisiin tiedonsiirtojärjestelmiin. Keksinnön eräessä edullisessa toteutusmuodossa keksinnön mukaista järjestelyä käytetään laajakaistaisen, yli 10 Mbit/s siirtävän tiedonsiirtojärjestelmän toteuttamiseen.

Edellä esitetyn mukaista järjestelyä voidaan lisäksi soveltaa esimerkiksi matkaviestinverkossa, jolloin keskusaseama 101 on edullisesti matkaviestinverkon kiinteään tiedonsiirto-osaan yhteydessä oleva keskusaseama ja ala-asema on edullisesti matkaviestinverkon tukiaseman yhteydessä, jolloin tukiaseman ja muun matkaviestinverkon välinen tiedonsiirto tapahtuu edellä kuvatun keksinnön mukaisen radiolinkkijär-

5 jestelyn avulla. Keksinnön mukaista radiolinkkijärjestelyä voidaan hyödyntää monien erilaisten matkaviestinjärjestelmien yhteydessä, kuten esimerkiksi GSM-järjestelmän (Global System for Mobile communications) tai UMTS-järjestelmän (Universal Mobile Telecommunication System) yhteydessä. Tällaisessa sovellusmuodossa keskusasemalla on edullisesti kiinteä yhteys tai radiolinkkiyhteys tukiasemaohjaimeen BSC (base station controller).

Edellä keksintöä on selostettu eräisiin sen edullisiin sovellusmuotoihin viittaamalla, mutta on selvää, että keksintöä voidaan muunnella monin eri tavoin oheisten patenttivaatimusten määrittelemän keksinnöllisen ajatuksen mukaisesti.

Patenttivaatimukset

1. Radiolinkkijärjestelmän tiedonsiirtomenetelmä keskusasemalta (101) ja ainakin yhden ala-aseman (102) välillä, **tunnettu** siitä, että
 - keskusasema lähettää aikajakoista signaalia ensimmäisellä taajuudella,
 - 5 - keskusasema vastaanottaa mainitun ainakin yhden ala-aseman lähteitä toisella taajuudella, jolloin mainittu toinen taajuus on eri taajuus kuin mainittu ensimmäinen taajuus,
 - kukin mainituista ainakin yhdestä ala-asemasta vastaanottaa olennaisesti mainitulla ensimmäisellä taajuudella tiettyinä ensimmäisinä kyseistä ala-asemaa vastaavina
 - 10 ajanjaksoina, ja
 - kukin mainituista ainakin yhdestä ala-asemasta lähettää olennaisesti mainitulla toisella taajuudella tiettyinä toisina kyseistä ala-asemaa vastaavina ajanjaksoina, jolloin mainitut ensimmäiset ajanjaksot ovat eri ajanjaksoja kuin mainitut toiset ajanjaksot.
- 15 2. Patenttivaatimuksen 1 mukainen tiedonsiirtomenetelmä, **tunnettu** siitä, että keskusasema ohjaa ala-asemien lähetykseen ja vastaanottoon käyttämiä ajanjaksoja.
3. Radiolinkkijärjestelmä, joka käsittää keskusase­man (101) ja ainakin yhden ala-aseman (102), **tunnettu** siitä, että keskusasema käsittää välineet vastaanottosignaalien erottamiseksi lähetesignaaleista
- 20 taajuuden perusteella, ja siitä, että keskusasema on järjestetty lähettämään ensimmäisellä taajuudella ja vastaanottamaan toisella taajuudella, ja siitä, että ala-asema on järjestetty vastaanottamaan olennaisesti mainitulla ensimmäisellä taajuudella tiettyinä ensimmäisinä kyseistä ala-asemaa vastaavina ajanjaksoina ja lähettämään olennaisesti mainitulla toisella taajuudella tiettyinä toisina ky-
- 25 seistä ala-asemaa vastaavina ajanjaksoina, jolloin mainitut ensimmäiset ja toiset ajanjaksot ovat eri ajanjaksoja.
4. Patenttivaatimuksen 3 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että keskusasema on sovitettu valitsemaan mainitut ensimmäiset ja toiset ajanjaksot.
- 30 5. Patenttivaatimuksen 3 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että se on sijoitettu GSM-matkaviestinjärjestelmään.
6. Patenttivaatimuksen 3 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että se on sijoitettu UMTS-matkaviestinjärjestelmään.

7. Patenttivaatimuksen 3 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että se on sijoitettu laajakaistaiseen tiedonsiirtojärjestelmään.
8. Patenttivaatimuksen 7 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että se on sijoitettu LMDS-järjestelmään.
- 5 9. Patenttivaatimuksen 7 mukainen radiolinkkijärjestelmä, **tunnettu** siitä, että se on sijoitettu HiperAccess-järjestelmään.

(57) Tiivistelmä

Tämä keksintö koskee tiedonsiirtoa mikroaaltolinkkijärjestelmässä erityisesti point-to-multipoint-yhteyksien avulla. Keksinnön mukaisessa järjestelyssä käytetään sekä taajuus- että aikajakoista järjestelyä ala-asemien rakenteiden yksinkertaistamiseksi. Keksinnön mukaisesti ala-asema lähettää eri aikana kuin se vastaanottaa, ja käyttää lähetykseen ja vastaanottoon eri taajuuksia. Keskusasema puolestaan on varustettu dupleksointiyksiköllä, jolloin se voi sekä lähettää että vastaanottaa samanaikaisesti, kun lähetys- ja vastaanottotaajuudet ovat riittävästi toisistaan eroavat. Tällaisella järjestelyllä saavutetaan aikajakoisen järjestelyn etuja, kuten esimerkiksi halpa alaseaman rakenne, ilman aikajakoisen järjestelyn aiheuttamia haittoja.

Kuva 3

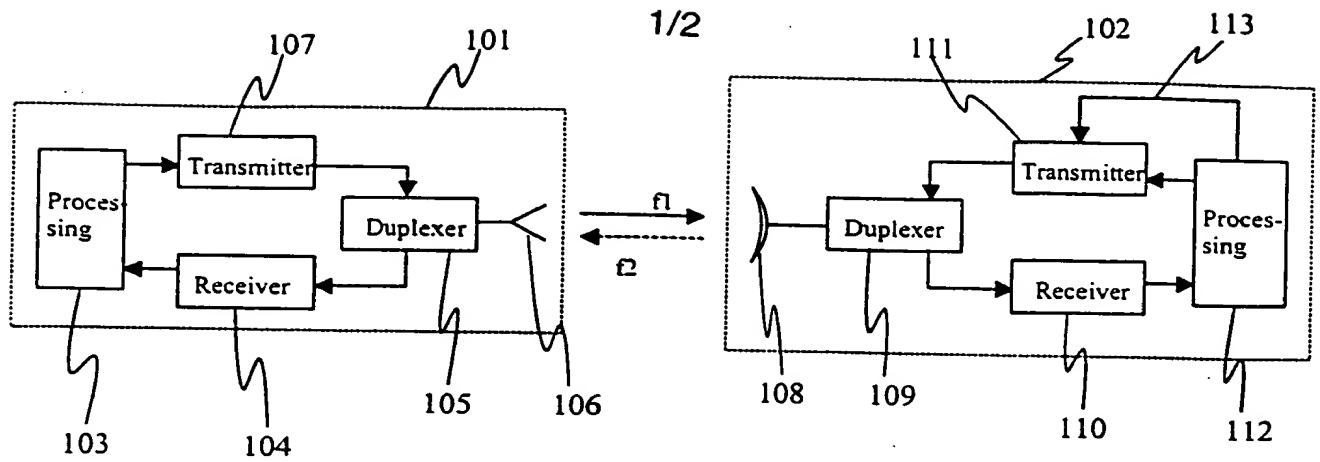


Fig. 1

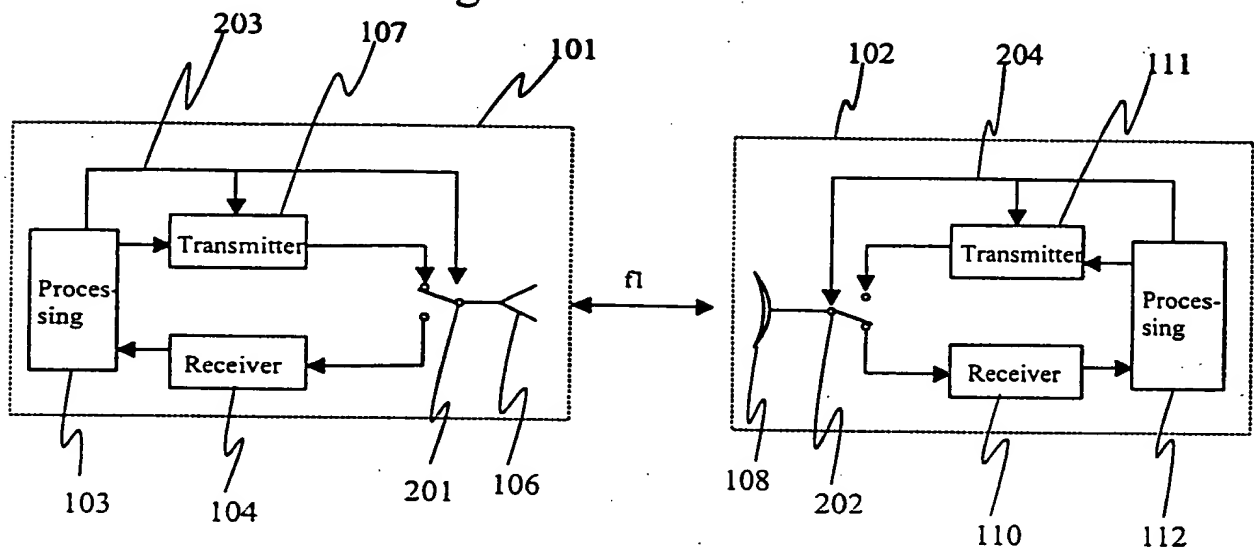


Fig. 2

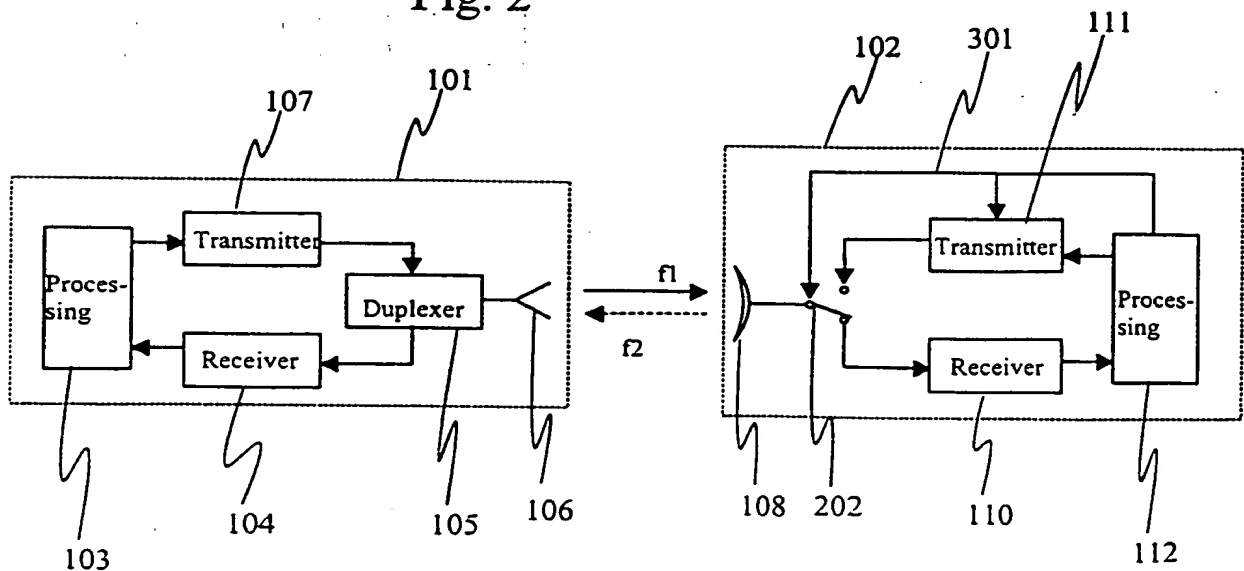


Fig. 3

2/2

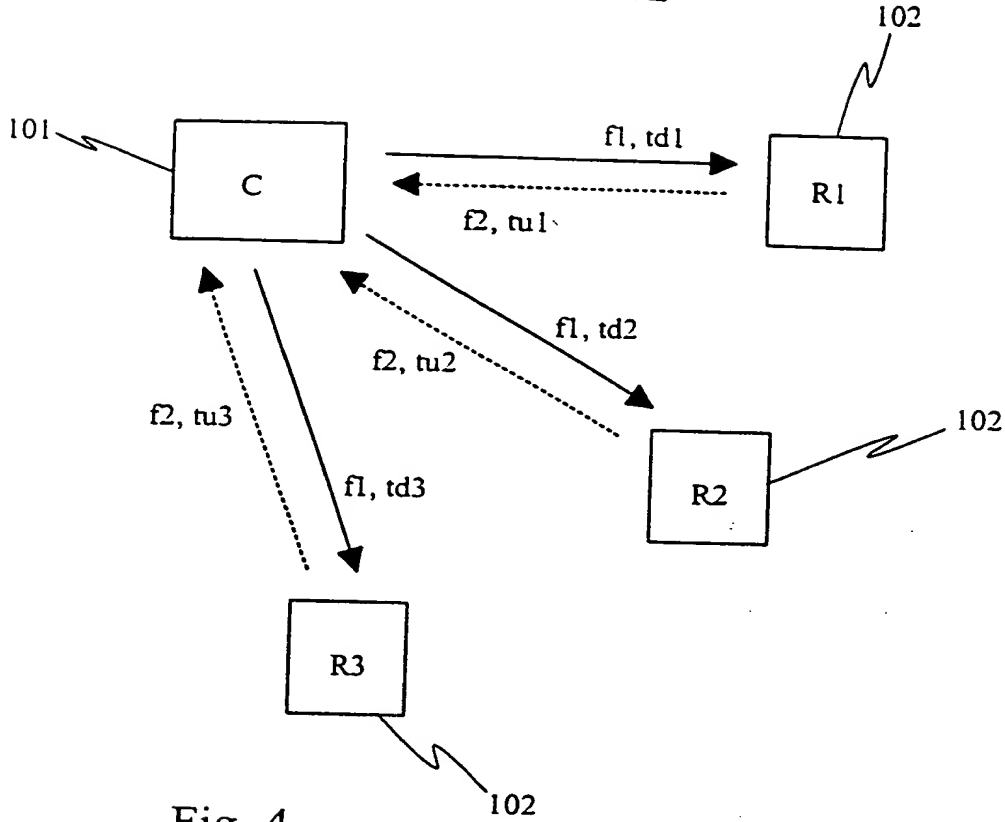


Fig. 4

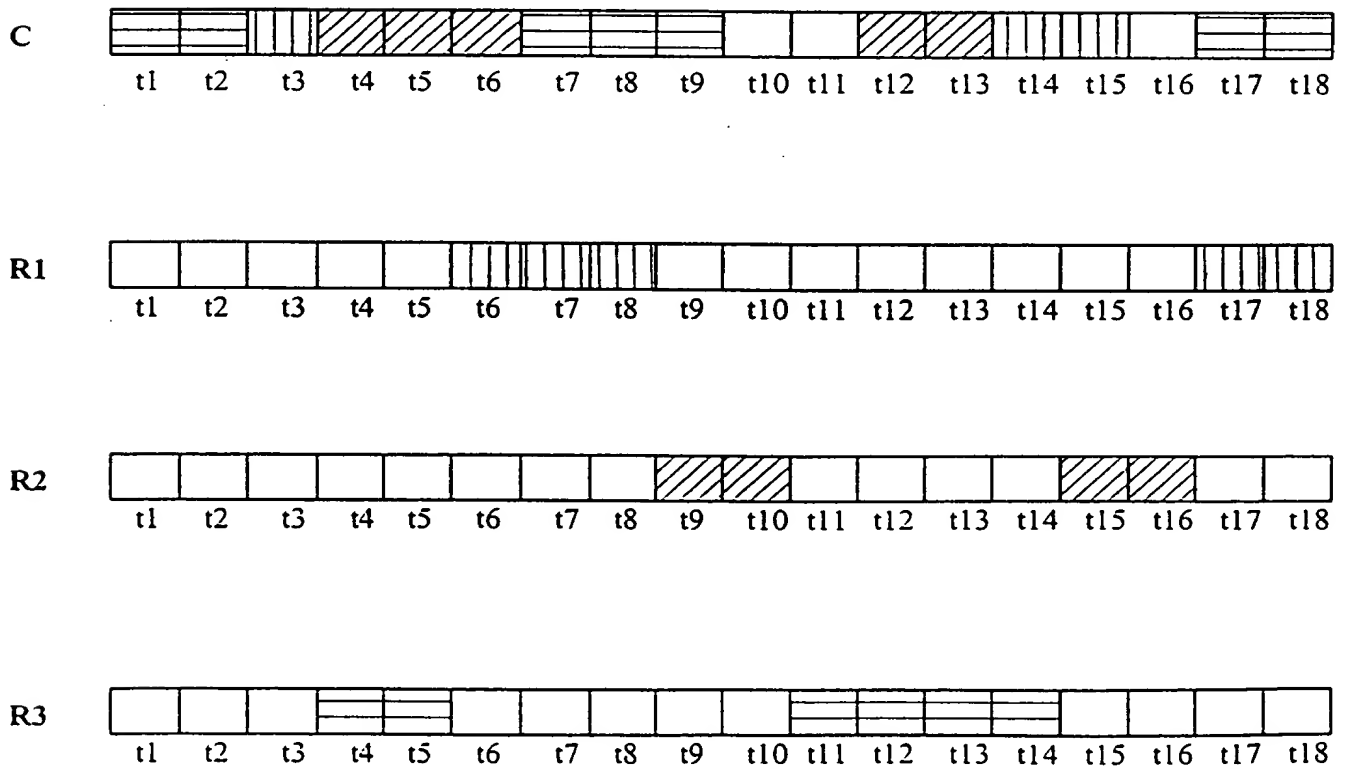


Fig. 5

PATENTTIHAKEMUS NRO Appln. No. 990483	LUOKITUS Classification H04B1/50, H04B7/155, H04Q11/04, H04J15/00
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TUTKITTU AINEISTO Research material
Patenttijulkaisukokoelma (FI, SE, NO, DK, DE, CH, EP, WO, GB, US), tutkitut luokat H04B1/50, H04B7/155, H04Q11/04, H04Q7/36, H04Q7/00, H04Q7/30, H04J15/00 Published patent specification, researched classes
Tiedonhaut ja muu aineisto Data search and other material EPOQUE tietokannat EPODOC, WPI, PAJ, fulltext tietokannat englisht, germant, frencht

VIITEJULKAISUT Reference publications		
Kategoria*) Category	Julkaisun tunnistetiedot Identification data	Koskee vaatimuksia
X	WO-A-9810566, H04L25/56, Netro Corporation	1-4
A	WO-A-9833338, H04Q7/36, Telefonaktiebolaget LM Ericsson	1,3
Y	DE-A-19610334, H04B1/38, Walke Bernhard Dr Ing	1,3
Y	DE-A-19605873, H04Q7/34, Walke Bernhard Dr Ing	1,3
A	US-A-5867487, H04J15/00, France Telecom	1,3
*) X Patentoitavuuden kannalta merkittävä julkaisu yksinään tarkasteltuna Y Patentoitavuuden kannalta merkittävä julkaisu, kun otetaan huomioon tämä ja yksi tai useampi samaan kategoriaan kuuluva julkaisu A Yleistä tekniikan tasoa edustava julkaisu, ei kuitenkaan patentoitavuuden este		
Päiväys Date 11.02.2000	Tutkija Examiner Jari Rantala	X) Particularly relevant if taken alone. Y) Particularly relevant if combined with another doc. of the same category. A) Technological background not a novelty bar.

Relevant to claims

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00174

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04B 7/24, H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5617412 A (M. DELPRAT ET AL.), 1 April 1997 (01.04.97), column 6, line 4 - line 13; column 1, line 38 - line 39 --	1,3,5,6
X,P	WO 9926437 A1 (ERICSSON INC.), 27 May 1999 (27.05.99), page 3, line 18 - line 24; page 3, line 24 - page 4, line 2, abstract --	1-4
A	US 5689502 A (L. SCOTT), 18 November 1997 (18.11.97), column 8, line 59 - column 9, line 10 -- -----	1,3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 July 2000

Date of mailing of the international search report

27-07-2000

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INTERNATIONAL SEARCH REPORT
Information on patent family members

05/02/01

International application No.
PCT/FI 00/00174

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9721287	A1	12/06/97	EP	0865693 A	23/09/98
				US	5956326 A	21/09/99
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				BR	9814965 A	03/10/00
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				BR	9608548 A	06/07/99
				CA	2223321 A	12/12/96
				CN	1192300 A	02/09/98
				EP	0873593 A	28/10/98
				IL	118447 D	00/00/00
				WO	9639749 A	12/12/96

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CORRECTED

25 April 2001

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**REPLY TO WRITTEN OPINION
INTERNATIONAL PATENT APPLICATION PCT/FI00/00174
APPLICANT: NOKIA NETWORKS OY
DUE DATE: 1 MAY 2001**

In response to the Written Opinion mailed on 2 March, 2001 the independent claims are amended and we respectfully present the following.

The enclosed independent claims are amended to clarify the invention. The amended claims 1 and 5 specify that a central station transmits a time division multiplex signal and the signals transmitted by the substations form a time division multiple access signal. These amendments are supported by the specification (for example, page 5, lines 21-25 and page 7, lines 10-13) and drawing (Figure 5). The dependent claims are original claims.

The independent claims specify an arrangement and a method, where a central station transmits a typically continuous time division multiplex (TDM) signal at a first frequency and receives at a second frequency a time division multiple access (TDMA) signal formed of signals transmitted by substations. The invention teaches the separation of uplink and downlink transmissions from each other so that a base station may both transmit and receive continuously, while a substation need not transmit and receive simultaneously.

Document D1 presents a system, where two terminals communicate at one direction using a first frequency during a certain time interval and to the opposite direction using a second frequency during another time interval. D1 thus teaches the use of different frequencies at opposite directions. Neither of the terminals transmits a continuous signal; they both switch between transmit and receive modes.

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Document D2 presents a frequency division half-duplex system with frequency division multiple access (FDMA), where a transmitting terminal at certain times stops transmission in order to listen to possible incoming control signals and then resumes transmission. In the uplink direction FDMA is used instead of TDMA, which is used in the invention in the uplink direction.

Document D3 presents a time division duplex communication system between base station and substations. It deals with propagation delay compensation and not duplexing methods, and therefore seems not to be very relevant.

We respectfully argue that none of the documents describing prior art nor they combination presents the idea of the invention. We therefore further argue that the claimed solution is novel and inventive.

A reconsideration of the Written Opinion is respectfully requested.

In addition to amending claims, minor amendments are made to the description: a reference number is corrected on page 2, line 18 and unnecessary repetition is removed from a sentence on page 3, line 26. Replacement pages 2 and 3 are enclosed.

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Encl. Replacement pages 2, 3, 10 and 11

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the substations transmit to the central station at their particular frequencies whereby the central station could discriminate the signals of the different substations by their transmission frequencies. In a code division multiple access (CDMA) arrangement the signals on the same signal path are discriminated on the basis of spreading codes.

Fig. 1 shows a prior-art frequency division duplex arrangement for discriminating between the uplink and downlink directions in point-to-multipoint connections. A central station 101 comprises a baseband processing unit 103. A transmitter unit 107 and receiver unit 104 take care of functions related to the transmission and reception of signals. A duplexer unit 105 couples both the transmitter unit 107 and the receiver unit 104 to an antenna so that they can transmit or receive signals through a single antenna 106. The coupling is such that at a particular frequency the duplexer unit 105 couples the transmitter unit 111 to the antenna 106 and at a second particular frequency the duplexer unit 105 couples the receiver unit 104 to the antenna 106. The duplexer unit is usually realized by means of filters. Correspondingly, a substation 102 is arranged so as to comprise the corresponding units for receiving and transmitting signals. The substation 102 includes an antenna 108, duplexer unit 109, transmitter unit 107, receiver unit 110 and a processing unit 112. In the arrangement according to Fig. 1 the central station 101 and substation 102 use two different frequencies f_1 ; f_2 to transmit signals. All substations 102 communicating with one and the same central station 101 use substantially the same transmission frequency to communicate with the central station 101. In addition, the substation 102 comprises an arrangement with which the processing unit 112 controls 113 the transmission of the transmitter unit 111.

Fig. 2 shows a prior-art time division duplex arrangement for transmitting data in point-to-multipoint connections. A central station 101 comprises a processing unit 103, transmitter unit 107, receiver unit 104 and an antenna 106. Additionally in a time division duplex system there is between the antenna 106 and transmitter unit 107 as well as receiver unit 104 a switch element 201 to control the transmission and reception of signals. In the central station 101 the processing unit 103 is arranged so as to control 203 the operation of the transmitter unit 107 and the switch element 201. A prior-art substation 102 in a time division duplex system comprises an antenna 108, switch element 202, transmitter unit 111, receiver unit 110 and a processing unit 112. The processing unit 112 controls 204 the receiver unit 110 and switch element 202 in the substation 102 so that transmission occurs in the right time slot. When using the time division duplex arrangement, only one frequency is

needed to convey the data since the transmission and reception are arranged so as to take place in different time slots.

Arrangements in accordance with Figs. 1 and 2 are used at microwave frequencies such as 2 GHz and higher. Such prior-art arrangements are used at frequencies of up to several tens of GHz.

Both the frequency division duplex and the time division duplex system have drawbacks in point-to-multipoint systems implemented in the microwave region. The biggest disadvantage of the frequency division duplex system is that it requires filters, which are expensive components. In the microwave region, signal conductors, i.e. waveguides and filters, are relatively large mechanical structures that have to be machined at very small tolerances. The pass bands of filters must be made quite narrow so that the transition from the pass band to the stop band be steep enough. Moreover, the gap between the frequency bands of the uplink and downlink directions is typically quite narrow, which adds to the steepness required of the filter. Therefore, the pass band of a steep enough filter typically does not suffice to cover the whole frequency band used by the system. Thus, in order to cover the various sub-bands the radio apparatuses of radio link systems must be implemented in several different versions. So, versions are installed for the central and substations according to the operating frequency. Especially it may be required that several parallel transceiver units adapted to the different sub-bands be installed at the central stations in accordance with the operating frequencies used.

This kind of an arrangement is naturally very expensive. The continual expansion of broadband data transmission and mobile communication systems adds to the need for microwave links, too, whereby it is obvious that simpler and less expensive solutions are needed to realize point-to-multipoint connections. In this patent application microwave frequencies refer to 2 GHz and higher frequencies.

Use of expensive filters can be avoided by means of the time division duplex arrangement mentioned above. However, compared to the frequency division duplex arrangement the time division duplex arrangement has its own disadvantages. Compared to a solution based on separate transmission and reception frequencies a time division duplex system achieves only half of the transmission rate of the frequency division duplex system, as the time has to be divided between transmission and reception. This disadvantage can be alleviated by using higher data rates but this, in turn, makes the apparatuses more complex since the clock fre-

Claims

1. A data transmission method of a radio link system between a central station (101) and at least one substation (102), **characterized** in that
 - the central station transmits a time division multiplex signal at a first frequency,
 - 5 - the central station receives signals of said at least one substation at a second frequency, said second frequency being a different frequency than said first frequency and said signals of said at least one substation at said second frequency forming a time division multiple access signal,
 - each of said at least one substation receives substantially at said first frequency
 - 10 during certain first time periods corresponding to the substation in question, and
 - each of said at least one substation transmits substantially at said second frequency during certain second time periods corresponding to the substation in question, whereby said first time periods are different time periods than said second time periods.
- 15 2. A data transmission method according to claim 1, **characterized** in that the central station controls the time periods used for transmission and reception by the substations.
3. A radio link system comprising a central station (101) and at least one substation (102), **characterized** in that
 - 20 the central station comprises means for discriminating reception signals from transmission signals on the basis of frequency,
 - and in that the central station is arranged so as to transmit a time division multiplex signal at a first frequency and receive a time division multiple access signal at a second frequency,
 - 25 and in that the substation is arranged so as to receive substantially at said first frequency during certain first time periods corresponding to the substation in question and to transmit substantially at said second frequency during certain second time periods corresponding to the substation in question, whereby said first and second time periods are different time periods and signals transmitted by said at
 - 30 least one substation at said second frequency are arranged to form said time division multiple access signal.
4. A radio link system according to claim 3, **characterized** in that the central station is adapted so as to select said first and second time periods.
5. A radio link system according to claim 3, **characterized** in that it is located in

a GSM mobile communication system.

6. A radio link system according to claim 3, **characterized** in that it is located in a UMTS mobile communication system.

5 7. A radio link system according to claim 3, **characterized** in that it is located in a broadband data transmission system.

8. A radio link system according to claim 7, **characterized** in that it is located in a LMDS system.

9. A radio link system according to claim 7, **characterized** in that it is located in a HiperAccess system.